

# CS112 – Java Programming

Fall 2022

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UNIVERSITY OF  
SAN FRANCISCO



Ph.D. EECS UCB. 30 years in tech—TV. 1<sup>st</sup> time teaching at USF, a lot to learn.

This is the computer I used for my first college computer science course as a freshman. DEC VAX 11/750. It was shared by 600 undergraduates. Four years later, everyone had a personal computer.

# Why are you taking this course?

Required for major, want the major  
Want to learn about computer programming because like it  
Want to learn what I like, figure CS could be it  
Heard prof is really good  
SHOW OF HANDS!

This course will teach you the secret to  
lifelong happiness

I'm not joking, entirely

Money

...is not it

([LINK](#))

Surveys show happiness plateaus after salary of about \$80k/year

I'll tell you what it is

Anybody want to cover your ears?

It is...

...working really hard at something you  
care about and succeeding at it

YOU WILL WORK HARD IN THIS CLASS. 12 hours per week, all in.

IF YOU WORK HARD, AND GET HELP WHEN YOU NEED TO, YOU WILL SUCCEED.


+++++

I spent 10 years in college. I currently have 3 kids in college. I know a lot about college.  
The lessons probably sound simple and boring but...

- Start assignments early. Every 1:45 class will have ~1 hr lec + 45 minutes to present/start HW, which I call "labs"
- Get help! I am a very informal guy. The TA's are great. Come talk w us
- A college student's most precious resource is TIME. Plan your time, use it efficiently. Plan work AND FUN!
- Get  $\geq 6$  hours of sleep per night. Try. I learned this as a junior. Once as a soph, I woke up at 8am Monday and went to bed at 11pm on Thursday. I was almost hit by a bus walking across a red light I didn't notice.

## Down to business

This course will cover...



- Programming in Java
- Software design, especially Object Oriented design
- Debugging
- Design & coding for ROBUSTNESS
- Intro to SW testing concepts
- Data types and data structures
- Recursion
- Brief intro to graphics

## Administrative topics (1 of 3)

**Attendance** not mandatory but strongly encouraged

**No make-ups** for late assignments, missed tests or quizzes

- Talk with me about exceptions e.g. with doctor's note

**Syllabus** online in Canvas. It is subject to change

**Office hours:** 11:30am – 12:30pm in person Mon/Wed, Harney 412B. Or by appt

- I am an informal guy—just shoot me a note saying “Can we talk 5 minutes on Friday?”

**TA's:** Kenny Tan (section #1) and Richard Dzureke (section #2)

**Textbook:** *Java Software Solutions* by Lewis and Loftus (8<sup>th</sup> or 9<sup>th</sup> edition)

Course **communication tools:** Canvas, Piazza, GitHub

You will not do well unless you attend classes regularly.  
Quizzes each only about 1% of grade.

INTERESTED IN ZYBOOKS? I can sign the class up. Optional, but very nice for review and practice exercises. Not cheap, I think \$77.



## Administrative topics (2 of 3)

Course components:

- Labs (homework): 25% of final grade
- Quizzes: 10%
- Two big projects: 25% total
- Midterm: 15%
- Final: 25%

I expect I will curve the final grade "somewhat".

Grades for SW depend both on correctness of code and clean professional coding style

- I will give guidelines
- I may give chance for you to re-clean project code  $\leq 1$  week after turned in

Curving: will not enforce Gaussian distribution. Will adjust grade thresholds so reasonable number of students get A's, B's, and C's.

I will announce statistics for projects, midterm, final, and maybe some update during term on labs/quizzes.

LATE homework/projects: share policy!

## Administrative topics (3 of 3)

**Honor Code** – zero tolerance for cheating

Scott and “C” in O-chem

Monica and "C-" in O-chem

If found guilty of cheating, your college transcript will say "Suspended for Honor Code violation" for the rest of your life

Guts of a  
computer



## Computer Guts

What can you name?

Let's take 5 minutes. Each of you find out for your own computer:

- Amount of memory
- Amount of nonvolatile memory (disk capacity)
- CPU type
- Operating system: type and version
- Display resolution

You will need this info for Lab01

Keyboard, memory, power supply, mouse, screen, persistent storage=disk, WiFi radio, Ethernet modem, camera, microphone, speakers, USB ports, cooling fans, case.  
CPU = Central Processing Unit

What does OPERATING SYSTEM do? Provides Services and Resources to programs: CPU, memory, network, printing, etc.

## Computer Guts

What can you name?

Let's take 5 minutes

- Amount of memory
- Amount of nonvolatile storage
- CPU type
- Operating system: type and version
- Display resolution

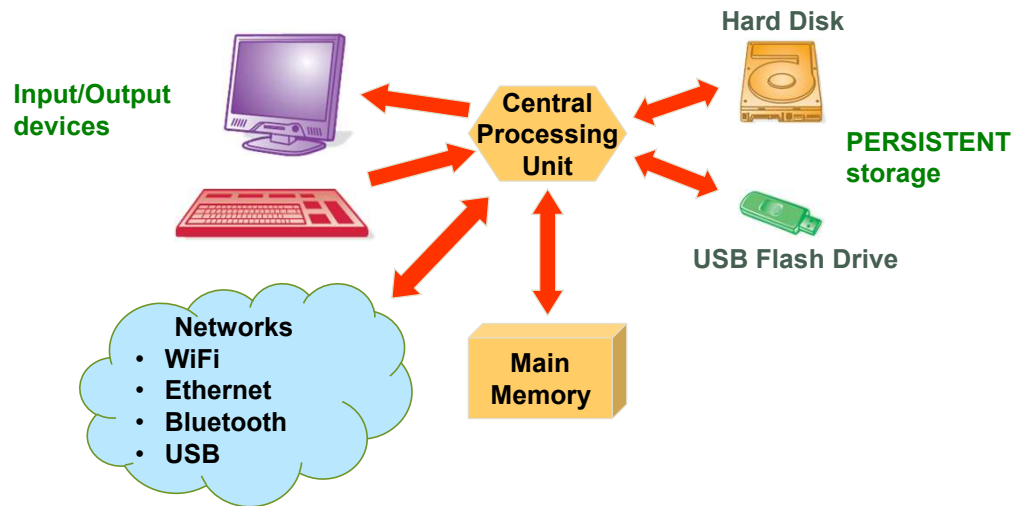
You will need this info for Lab01

My laptop is quite old:

- 8 GB memory
- 480 GB disk capacity
- Intel i3-2370M CPU (released January 2012)
- Windows 10 "21H2" version
- 1366x768 display

MacOS, Windows, Linux. Others: Android, VxWorks

## Primary components of a computer

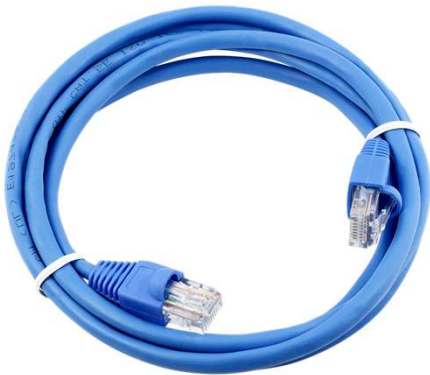


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OPEN UP THE BROKEN COMPUTER!

## Quick discussion on networks

WiFi, Ethernet



Bluetooth, USB



### Wired and wireless

- 1) IP protocol. Connect computers to other computers mostly. Email, WWW, file transfer, file sharing, etc
- 2) Connect a computer to I/O devices: keyboards, mouse, printer, headphones, nonvolatile storage. Screen clicker!

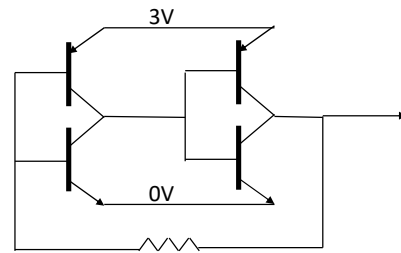
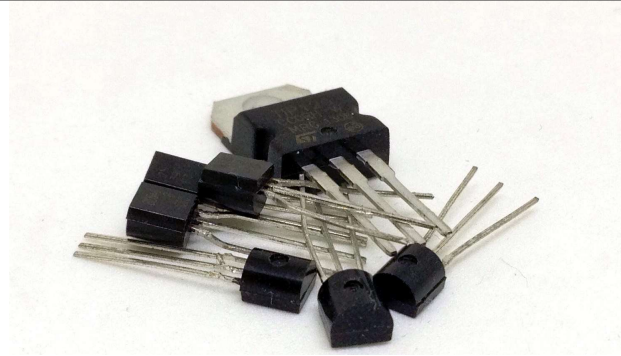
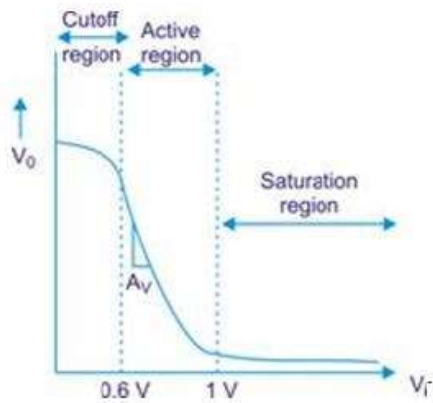
USB also supplies electrical power. My bicycle lights recharge via USB

Why ever use wired? Faster. More scalable. More secure

## Computer Memory

Built of transistors

A small “circuit” stores one of two states



“State” = ( $0\text{V}$ ,  $3\text{V}$ ) or (“low”, “high”) or (“0”, “1”)



## Computer Memory

From software view, computer memory acts like dictionary or look-up table

Address	Value
0000	0000 1111
0001	1111 1100
...	
1000	0011 0101
1001	0000 0000
1002	0000 0000
...	

A **bit** (**binary** digit) is something that can take one of two values

Traditionally computer memory structured so that each address maps to 8 bits = 1 byte

COMPUTERS USE BINARY BECAUSE OF HOW TRANSISTORS BEHAVE  
WHAT IS RANGE OF POSSIBLE VALUES WE CAN STORE WITH 8 BITS?

## Bit Permutations

<u>1 bit</u>	<u>2 bits</u>	<u>3 bits</u>	<u>4 bits</u>	
0	00	000	0000	1000
1	01	001	0001	1001
	10	010	0010	1010
	11	011	0011	1011
		100	0100	1100
		101	0101	1101
		110	0110	1110
		111	0111	1111

Each additional bit doubles the number of possible permutations

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Suppose we have 4 GB of memory in our computer. How many bits needed for address?  
(32)

## Computer Variables

We assign meanings (interpretations) to values: could be integers, floating point numbers, text strings, colors, etc.

Most computer languages let us use names rather than numerical addresses

Most computer languages let us group several addresses together, so a value can include more than 8 bits

Addresses	Name	Interpretation	Values
100-115	petName	"Paul's Gray Cat"	80, 97, 117, 108, 39, 115, 32, ... 116, 0
1000-1002	petColor	GRAY	20, 20, 20
1004-1007	sodaPrice	\$1.25	00, 01, 02, 05
1008-1015	PI	3.1415926	87, 225, 11, 0, 0, 113, 24, 77
1016-1031	worldPopulation	7999545000	63, 11, 24, 31, ..., 0
...			

## Central Processing Unit

Also built of transistors, more complicated circuits than memory

Functions of CPU: name some?

- 1) Read and write memory addresses/values. Read/write to other devices e.g. keyboard, mouse, disk, WiFi, USB, etc
- 2) Interpret some memory values as INSTRUCTIONS and execute those INSTRUCTIONS
- 3) System maintenance: keep track of time, temperature, etc

CPU: read and write memory and other devices (keyboard, mouse, disk, WiFi, USB, etc)

## CPU Instructions

Math: ADD, SUB, MULT, DIV

Logic: AND, OR, NOT, COMPARE

Program execution: JUMP to new instruction, CONDITIONAL jump

Data: LOAD, STORE

These instructions and their operands are stored as values in memory. CPU interprets the values as instructions. A program represented with these numerical values is called “machine code”.

Program from my CS-55 course:

- 005003
- 105004
- 051013
- 105023
- 005033 ...

Interpret some memory values as a sequence of INSTRUCTIONS, and perform those instructions

HUMAN BEINGS DO NOT LIKE READING OR WRITING MACHINE CODE.

## Types of CPUs

- Intel & AMD: x86 (from old chip names e.g. 80286)
- Apple: M1
- ARM, Motorola, etc

All have different machine languages. Software compiled for one type will not run on another type (must recompile).

## Reading

### *Java Software Solutions*

- For today: sections 1.1, 1.2, 1.3
- For next time: sections 1.4-1.6, 2.1-2.3



Lab01

Let's get to work...

THIS IS A REAL, GRADED LAB FOR THE COURSE. Mostly installing and setting up sw.  
We are here to help you all succeed with this one—lots of help. Don't be shy about asking.



## Lab01

### Goals:

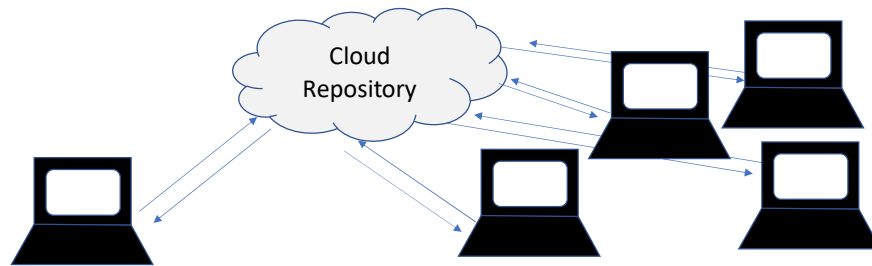
- Install and set up software that you will use to fetch course materials and turn in course assignments: Git and GitHub
- Start to become familiar with these tools
- Submit a few documents:
  - Confirm your success with Git and GitHub
  - Help me **learn your names**: some info and photo
  - LMK if this is a problem

## Git and GitHub

GitHub is a cloud based “repository” of files, like Google Docs, but for software source code

Throughout the course I will distribute files to you by uploading them to GitHub and telling you to download them

You will submit assignments by uploading them to GitHub before assignment deadlines. The TA’s and I will retrieve them and grade them (and enter grades in Canvas)



## Lab01

Take a break whenever you need to

Then please retrieve Lab01 instructions from  
<https://www.cs.usfca.edu/~phaskell/Lab01.pdf>

All documentation for this course:

- All following Lab assignments
- Projects
- Lecture notes
- Etc

will be distributed via GitHub (not Canvas)

LOOK AT GITHUB PAGE FOR COURSEINFO. SEE README.md FILE!